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内蒙古二连浩特呼尔井组的某些啮齿类化石[1)]

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摘要:描述了产自二连浩特呼尔井组的啮齿类化石:*Allosminthus* cf. *A. diconjugatus*, *A. majusculus*, *A. ernos*, *Prosciurus pristinus* sp. nov. 和 Marmotini gen. et sp. indet.。*Prosciurus pristinus* 的特征是P4 的前附尖较弱小,p4 无下中附尖和下中尖,以及下次脊较低弱等。认为 *Banyuesminthus* 是 *Allosminthus* 的后出同物异名。上述啮齿类的发现也证明呼尔井组的时代为晚始新世。
关键词:内蒙古,晚始新世,跳鼠科,山河狸科,松鼠科
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二连浩特附近的呼尔井组是美国纽约自然历史博物馆中亚考察队 1922 年发现的。其中所产的哺乳动物化石已有一些报道(Matthew and Granger, 1923; Wang, 2001, 2007a, b)。有关呼尔井组及其所产哺乳动物群的性质和特点,笔者将另文详细讨论。这里仅对在 20 世纪 80-90 年代用筛洗法从二连浩特附近呼尔井组中采集到的,除梳趾鼠类和仓鼠类化石以外的一些啮齿类(包括跳鼠、山河狸和松鼠类)进行报道。它们均是在该地区呼尔井组中的首次发现。这不但扩大了这些门类的分布范围,为该动物群增加了新的种类,而且对确定该动物群的地质时代提供了新的依据。

跳鼠類齿冠面要素的名称主要依 Wang (1985)。缩写:IVPP,中国科学院古脊椎动物与古人类研究所;IVPP Loc., IVPP 野外地点号;IVPP V, IVPP 脊椎动物化石编号;L,长;W,宽。测量均以毫米为单位。

1 系统描述

跳鼠科 Dipodidae Fischer de Waldheim,1817
异蹶鼠 *Allosminthus* Wang,1985

Banyuesminthus Tong, 1997:135-138, 236-237; figs. 63-64; Pl. XI, figs. 15-23

属型种 蕾异蹶鼠 *Allosminthus ernos* Wang, 1985。

归入种 大异蹶鼠 *Allosminthus majusculus* Wang, 1985;双连异蹶鼠 *A. diconjugatus* (Tong, 1997);双连异蹶鼠(相似种)*A.* cf. *A. diconjugatus*;单连异蹶鼠 *A. uniconjugatus*

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(Tong, 1997)和异蹶鼠(未定种)*Allosminthus* sp.。

地理和时代分布 亚洲,中始新世晚期－晚始新世。

特征(修订) 较原始的跳鼠。齿式:1·0·1·3/1·0·0·3。齿冠低,主齿尖较粗壮,齿脊较细弱。M1 和 M2 大小相近。上臼齿中脊短或无,后脊和内脊完全,次尖前臂伸向牙齿中央。M1 原尖前臂与前尖连接,形成完全的原脊 I;前尖的后舌侧脊趋于与原尖后臂相连形成原脊 II。M2 和 M3 的后脊伸达次尖前臂。下臼齿具下外脊;下中脊短或无。m1 和 m2 下后脊 II 和下次脊完全。m1 下三角座短而窄,下前边尖很小。m2 下前边尖位于牙齿纵轴附近。m3 下后脊 II 较弱小,无下次脊。

讨论 童永生(1997:135)根据山西垣曲和河南渑池的材料建立了 *Banyuesminthus* 新属。该属包括 *B. diconjugatus* 和 *B. uniconjugatus* 两新种。童永生列举的该属的鉴定特征是:“牙齿比 *Primisminthus* 稍大。M1 和 M2 大小相近,上臼齿成矩形,长大于宽,中脊相对发育,次尖前棱伸向牙齿中央。M1 原尖前棱与前尖连接,前尖后棱存在,强弱有变化,原尖和前尖间趋于双连接,后尖成脊状,后脊伸向次尖,前齿带连续。M2 前尖后棱极弱或无,后脊伸向次尖前棱。下臼齿下外脊相对发育,m2 具初始的下后尖前棱,但不与下原尖前棱相连,下前边尖在牙齿纵轴附近”。童永生(1997)在建 *Banyuesminthus* 时并未将该属与 *Allosminthus* 属进行比较。笔者观察比较了有关属、种的标本后发现,*Banyuesminthus* 这些特征与 Wang (1985)所建的异蹶鼠(*Allosminthus*)的特征基本相同。而且该 2 属的属型种的基本特征也相同,所不同的是 *Allosminthus* 的属型种(*A. ernos*)的 M1 的前尖后内侧脊较短,后脊只在少部分标本中(约 1/3)与次尖连,在大部分标本中(约 2/3)与次尖前臂连,以及 m2 的下后脊 I 在部分标本中与下原尖前臂连。这些特征都只是 *A. ernos* 种内的个体变异,而且其 M1 前尖的后内侧脊较短的特点与童永生(1997)归入 *Banyuesminthus* 属的另一种 *B. uniconjugatus* 的一致。它们的颊齿的尺寸也无明显的区别, 如 *A. ernos* 的虽较 *B. diconjugatus* 的稍小,但确与 *B. uniconjugatus* 的相近;而 *B. diconjugatus* 的尺寸则与 *Allosminthus* sp. 的相近,比 *A. majusculus* 的小。因此,*A. ernos* 的上述区别特征最多只能作为它与 *Banyuesminthus diconjugatus* 的种间区别。把它们作为属的区别特征显然是不合适的。因此,*Banyuesminthus* 应为 *Allosminthus* 的后出同物异名。

双连异蹶鼠(相似种)*Allosminthus* cf. *A. diconjugatus* (Tong, 1997)

(图 1;表 1)

标本 3 M1 (IVPP V 14990.1-3), 1 M3 (V 14990.4), 3 m1 (V 14990.5-7)和 4 m2 (V 14990.8-11)。

地点和层位 内蒙古二连浩特火车站东 IVPP Loc. 1988001,上始新统呼尔井组。

描述和比较 臼齿齿冠低,主齿尖明显,均为较细锐的丘形,横脊较细长。M1 冠面为矩形,长稍大于宽。原尖前臂与前尖连,形成完全的原脊 I。由前尖伸出的后舌侧脊[= 童永生(1997)前尖后棱]与原尖伸出的横脊连,形成完全的原脊 II,但其中部很低,明显凹下。后脊与次尖前部连。次尖前臂伸达明显的中尖。中脊短。原尖后臂很弱,伸达次尖前臂,形成内脊。前齿带很发育。

童永生(1997)描述的 *A. diconjugatus* 无 M3,但 *A. uniconjugatus* 有 2 枚 M3。因

V 14990.4 的形态特征虽与 *A. uniconjugatus* 的相似,但其齿脊稍发达些,故被归入此种。这一 M3 的冠面约为三角形。原脊单一,由前尖伸达原尖前臂。前齿带很发达,被发达的前边附尖分为长的颊部和短而向内下斜的舌部。齿的后部明显退化变窄,次尖比原尖低小得多。后尖比次尖还低小,不明显。后脊完全,与次尖前臂连。无明显的中附尖。由后脊舌部有一向前外方斜伸的短脊,有可能代表短的中脊。内脊完全,由原尖后臂与次尖前臂相连而成。内凹较 M1 的浅小,与中凹分开。

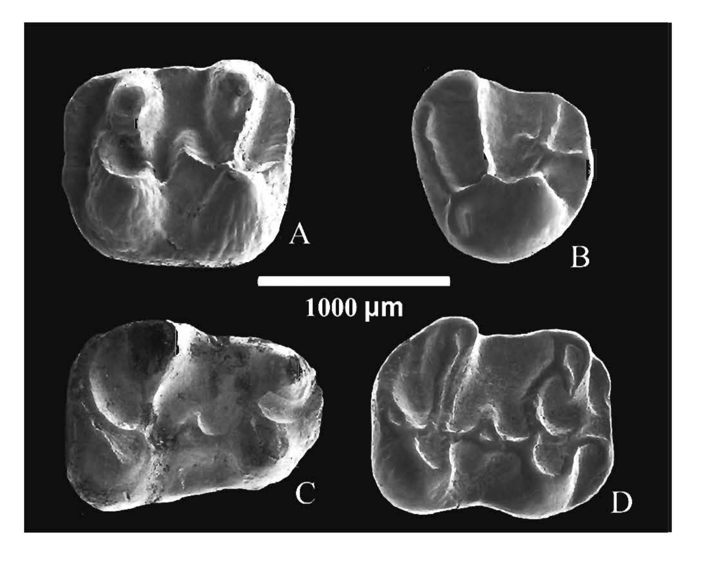


图 1　双连异蹶鼠(相似种)颊齿冠面

Fig. 1　Occlusal view of cheek teeth of *Allosminthus* cf. *A. diconjugatus*

A. 左 left M1 (V 14990.1); B. 左 left M3 (V 14990.4); C. 右 right m1 (V 14990.5); D. 右 right m2 (V 14990.9)

m1 下三角座短窄,下前边尖小,紧靠二前主尖。下原尖和下后尖彼此靠近,约在同一横线上。下后脊 II 短而完全。下内尖的位置较下次尖稍靠前。下次脊与下次尖前部连。下外脊完全,具发达的下中尖和短的下中脊。m2 的 4 个主尖大小相近,下后尖和下内尖位置分别较下原尖和下次尖的稍靠前。下后脊 I 完全,与下原尖前臂连。下后脊 II 短而完全,封闭下三角盆。下外脊直而完全。下中尖很发达。下中脊短,比下后脊 II 短。下中附尖小。前齿带很发育,下前边尖大,约位于齿中纵轴附近。m2 的后半部与 m1 的相同。

二连浩特标本冠面的基本形态与 *A. diconjugatus* 的很相似,尺寸也相近(见表 1)。所不同的是它的上臼齿的主齿尖较锐,横脊相对较细长;m2 的下后脊 I 完全,与下原尖前臂连等。

Allosminthus 目前已知包括 5 种:中始新世晚期的 *A. uniconjugatus*,中始新世最晚期 - 晚始新世的 *A. diconjugatus*,晚始新世的 *A. ernos*, *A. majusculus* 和 *Allosminthus* sp. 。从它们出现的时代判断,*Allosminthus* 的臼齿似乎存有齿脊由不发育到较发育,下臼齿的下后脊 I 由无到有,再到完全的进化趋势,二连标本的上述特点表明 *A.* cf. *A. diconjungatus* 有可能较 *A. diconjungatus* 稍进步些。

大异蹶鼠 *Allosminthus majusculus* Wang, 1985

(图 2;表 1)

标本　左 m1 (IVPP V 14991.1)、右 m1 (V 14991.2)和右 m2(V 14991.3)各 1 枚。

地点和层位　内蒙古二连浩特火车站东 IVPP Loc. 1988001,上始新统呼尔井组。

描述和比较　臼齿齿冠低,具较粗壮的尖和较发达的脊。m2 具完全的下后脊 I 和 II。下外脊完全,下中脊短。具明显的下中尖和下外中脊。下次脊与下次尖前臂连等均与 *A. majusculus* 的一致。其尺寸也与后者很相近。所不同的是 V 14991.3 缺游离的下次尖后臂。考虑到有

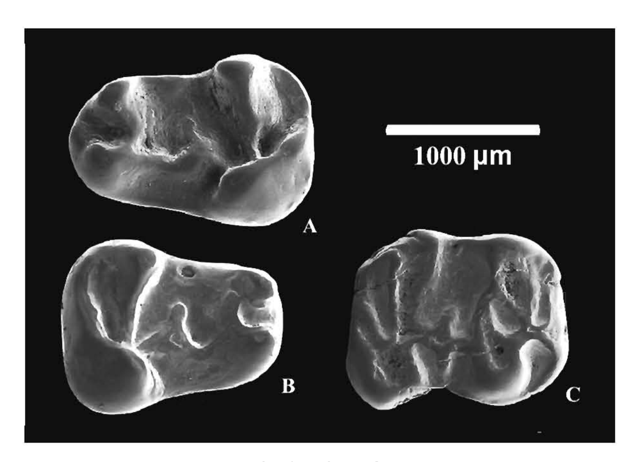


图2　大异蹶鼠臼齿冠面
Fig. 2　Occlusal view of lower molars of *Allosminthus majusculus*
A. 左 left m1 (V 14991.1); B. 右 right m1(V 14991.2); C. 右 right m2 (V 14991.3)

无游离的下次尖后臂在 *Allosminthus* 中是变异的，暂时将 V 14991.3 归入 *A. majusculus* 种。因 *A. majusculus* 过去仅已知 m2，无 m1，这次发现了 2 枚 m1，其形态结构和尺寸均与 *A. majusculus* 的 m2 相对应，被归入此种。现对 m1 作较详细描述。m1 冠面为前部窄的长卵圆形。下三角座很短而窄。下原尖和下后尖大小相近，彼此相对，很靠近。下前边尖低小或无。下后脊 II 完全，短而较低。下次尖和下内尖较前面二主尖的大，该二尖也在同一横线上。下次脊横向，或稍向后外斜，与下次尖后部连。下外脊长而完全，稍曲折。下中尖很发达，下中脊中等长度。下中附尖明显。下次小尖小而明显。这些特征也与 *Allosminthus* 的一致(测量见表 1)。

表 1　二连浩特呼尔井组的异蹶鼠臼齿测量

Table 1　Measurements of molars of *Allosminthus*　　(mm)

	Allosminthus					
	cf. *A. diconjugatus*		*majusculus*		*ernos*	
	N	R				
M1 L	2	1.06 ~ 1.1				
M1 W	3	1.0 ~ 0.9				
M3 L	1	0.8				
M3 W	1	0.9				
m1 L	1	1.2e	2	1.4 ~ 1.6		
m1 W	3	0.9 ~ 0.95	2	1.1		
m2 L	4	1.1 ~ 1.35	1	1.45	1	1.06
m2 W	4	0.9 ~ 1.1	1	1.2	1	0.76 +

缩写(Abbreviations): N. 标本数 number; R. 变异范围 range; e. 大约 estimated.

蕾异蹶鼠 *Allosminthus ernos* Wang, 1985

(图 3; 表 1)

在二连浩特火车站东 IVPP Loc. 1988001 的上始新统呼尔井组中还发现了一枚左 m2 (IVPP V 14992)。其前内侧和后外侧均破损。该 m2 的齿冠低，齿尖较钝，齿脊较低。下原尖前臂与下前边尖连。下后脊 I 完全，稍向前外方斜，与明显的下前边尖连。下后脊 II 完全，较低。下外脊直而完全。具下中尖和短而弱的下中脊。下次脊与下次尖前臂连等特征均与 *Allosminthus ernos* 的一致。其尺寸(见表 1)也在该

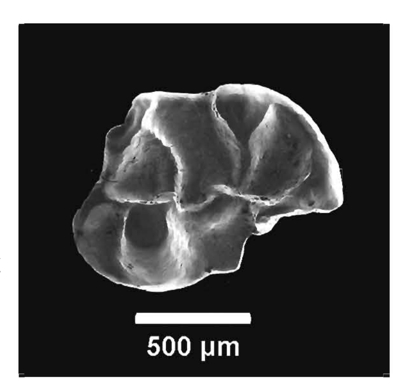


图3　蕾异蹶鼠左 m2 (V 14992) 冠面
Fig. 3　Occlusal view of left m2 (V 14992) of *Allosminthus ernos*

种的变异范围内。

山河狸科 Aplodontidae Brandt,1855
原松鼠属 *Prosciurus* Matthew,1903
原始原松鼠(新种) *Prosciurus pristinus* sp. nov.

(图 4)

正型标本　左 p4(IVPP V 13575.1)。

归入标本　左 P4 (V 13575.2)。

地点和层位　内蒙古二连浩特火车站东 IVPP Loc. 1988001,上始新统呼尔井组。

特征　较原始的原松鼠,个体中等大小。P4 前附尖弱小;后小尖为单尖,很发达;p4 无下中附尖、下中尖和下外中脊,下次脊低弱与下后边脊连。

词源　Pristinus, 拉丁文,早的,原始的。

描述和比较　P4 的齿内侧稍缺损,但仍可见其外缘长于内缘。其前侧有与 P3 的小接触面,说明生前有 P3 存在。P4 和 p4 齿冠较低,未见单面高冠现象。P4 臼齿化,具明显的前附尖。前尖和后尖均略呈三角锥形。原脊和后脊相对较细,但比前边脊和后边脊高,分别与原小尖后缘和后小尖前缘连。原脊完全,伸达原尖。后脊似不与原尖连。原小尖、后小尖和中附尖均发育,以后小尖最发达。P4 长, 2.06 mm。p4 下三角座高而窄于下跟座。下原尖位置较下后尖的稍后移。下后脊 II 短而完全,无下后脊 I。下次尖较膨大,但不特别向前延伸。下内尖较小,与下后边脊分开。下次脊较细弱,与下次小尖连。p4 (L×W):2.1 mm×2.1 mm。

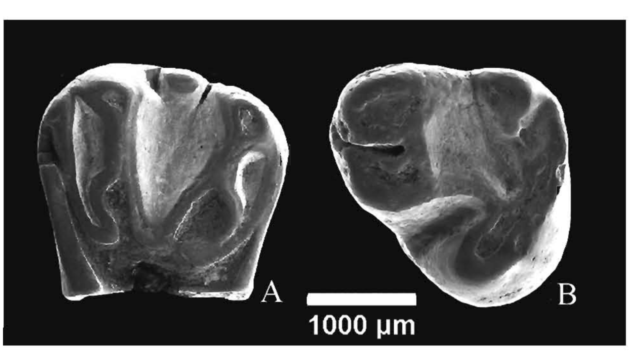


图 4　原始原松鼠(新种)颊齿冠面

Fig.4　Occlusal view of cheek teeth of *Prosciurus pristinus* sp. nov.
A. 左 left P4 (V 13575.2);
B. 左 left p4,正型标本(V 13575.1, holotype)

P4 与 p4 的基本形态结构均与 *Prosciurus* 的相同,显然应归入该属。目前该属已知 9 个种: *P. vetustus*, *P. relictus*, *P. saskatchewensis*, *P. parvus*, *P. magnus*, *P. ordosius*, *P. mongoliensis*, *P.* cf. *P. mongoliensis* 和 *P. pisinnus* (Wood, 1937, 1980; Russell, 1972; Wang, 1987; Korth, 1989; Wang and Dashzeveg, 2005)。二连的标本在尺寸上比 *P. saskatchewensis* 和 *P. magnus* 的小,比 *P. parvus*, *P.* cf. *P. mongoliensis* 和 *P. pisinnus* 的大。在形态上它与 *Prosciurus* 上述已知种均有明显区别:它的 P4 的前附尖较弱小,不特别向前凸,而且比晚始新世的 *P. saskatchewensis* 的还要显得弱小些;它的 p4 无下中附尖、下中尖和下外中脊,下次脊细弱等。此外,它的 P4 的后小尖为单尖的特点也与 *P. vetustus* 的不同。p4 下次脊与下后边脊连的特点也与 *P. relictus* 和 *P. pisinnus* 的区别。上述区别特征均为较原始的特征。二连的标本很可能代表 *Prosciurus* 的一较原始的新种,被称为原始

原松鼠(*Prosciurus pristinus*)。

Prosciurus 目前已知分布于北美和亚洲。在北美的时代分布为晚始新世 Chadronian 期到早渐新世 Whitneyan 期,而在亚洲过去已知仅出现在早渐新世(McKenna and Bell, 1997;Wang, 1987; Wang and Dashzeveg, 2005)。由上面的比较可以看出,在二连呼尔井组中发现的 *P. pristinus* 要比北美晚始新世的 *P. saskatchewensis* 的还要原始些。这表明 *P. pristinus* 的时代有可能比后者稍早,或大致相当,晚于晚始新世的可能性较小。如果这种考虑是合理的话,这就意味着这是亚洲目前已知最早的 *Prosciurus*,也就是说 *Prosciurus* 在亚洲晚始新世即已出现。这样,该属在亚洲的时代分布应为晚始新世到早渐新世。

松鼠科 Sciuridae Fischer de Waldheim,1917

旱獭族 Marmotini Pocock,1923

旱獭族(属、种未定)Marmotini gen. et sp. indet.

(图5)

在内蒙古二连浩特火车站东 IVPP Loc. 1988001 的上始新统呼尔井组中,还发现了一枚左 M1(或 M2,这里以 M1/2 标示;IVPP V 15003)。该 M1/2 后外角破损。齿冠近正方形,舌侧齿冠明显高于颊侧的。原尖前后伸长,几乎完全占据了齿的舌侧。无明显的次尖。有4横脊,前边脊、原脊和后边脊均完全,后脊不完全,不与原尖连。原小尖小,后小尖很发达。M1/2 的这些特征与松鼠亚科,特别是旱獭族的地松鼠 *Spermophilus* 的较相似(Black, 1963;McKenna and Bell, 1997)。M1/2 长: 2.1 mm,宽: 2.1 mm。

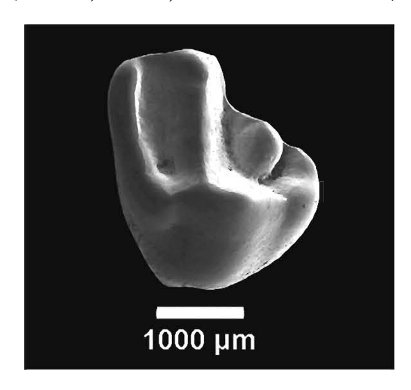


图5 旱獭族(属、种未定)左 M1/2 (V 15003)冠面

Fig. 5 Occlusal view of left M1/2 (V 15003) of Marmotini gen. et sp. indet.

目前已知旱獭族的时代分布在欧洲为早渐新世-现在;在北美为晚渐新世-现在,地中海为晚中新世,而在亚洲为早中新世-现在(McKenna and Bell, 1997)。尽管我们只发现了一枚不完整的 M1/2,如果上述归属是合理的话,该 M1/2 的发现还是很有意义的。这至少表明,旱獭族在亚洲出现得比已知的早得多,在晚始新世就已出现了。这样,V 15003 代表了目前世界上已知最早的旱獭。

2 关于二连浩特呼尔井组的时代

本文描述的产自呼尔井组的化石为:*Allosminthus* cf. *A. diconjugatus*, *A. majusculus*, *A. ernos*, *Prosciurus pristinus* 和 Marmotini indet. 等。如前所述,*P. pristinus* 较原始,其时代很可能为晚始新世。*Allosminthus* 属的已知时代为中始新世晚期-晚始新世。其中 *A. majusculus* 和 *A. ernos* 已知产于云南曲靖晚始新世的蔡家冲组(Wang,1985)。*A. diconjugatus* 的已知时代分布为中始新世最晚期-晚始新世(童永生,1997),但 *A.* cf. *A. diconjugatus* 显得要比 *A. diconjugatus* 稍进步些。从 *Allosminthus* 的3个种来看,其时代

也是以晚始新世为宜。这与前人根据呼尔井组中产的其他哺乳动物化石分析所得出的结论是一致的(详见王伴月,1997, 2001,2007a, b; 邱占祥、王伴月,2007)。旱獭族目前已知在欧洲出现最早,为早渐新世;北美次之,为晚渐新世;而在亚洲最早是早中新世。呼尔井组中产有旱獭类的化石,表明旱獭类在亚洲早在晚始新世就出现了。不过,呼尔井组中产有旱獭类化石,也可能表明呼尔井组的时代稍晚,可能为晚始新世稍晚期。这一看法也与根据巨犀和仓鼠化石所得出的结论相符(邱占祥、王伴月,2007;王伴月,2007b)。

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ADDITIONAL RODENT MATERIAL FROM HOULDJIN FORMATION OF ERENHOT, NEI MONGOL, CHINA

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Key words　Nei Mongol, Late Eocene, Dipodidae, Aplodontidae, Sciuridae

Summary

Dipodids, aplodontids and sciurids recently collected from the Houldjin Formation in Erenhot, Nei Mongol, were described. All of them represent the first records of their kinds in Late Eocene of Nei Mongol. The discovery has not only expanded the distribution of these taxa in Asia, added new elements to the Houldjin fauna, but also provided new information in age determination of the Houldjin Formation. All the fossils described here were collected from IVPP Loc. 1988001, east to the Railway Station of Erenhot.

1　Systematics

Dipodidae Fischer de Waldheim, 1817
***Allosminthus* Wang, 1985**

Banyuesminthus Tong, 1997:135-138, 236-237; figs. 63-64; Pl. XI, figs. 15-23

Type species　*Allosminthus ernos* Wang, 1985.

Included species　*Allosminthus majusculus* Wang, 1985; *A. diconjugatus* (Tong, 1997); *A.* cf. *A. diconjugatus*; *A. uniconjugatus* (Tong, 1997) and *Allosminthus* sp.

Geographic distribution and geological range　Asia, late Middle Eocene - Late Eocene.

Emended diagnosis　A primitive dipodid. Dental formula: 1 · 0 · 1 · 3/1 · 0 · 0 · 3. Crown brachydont, with obtuse main cusps and lower and weaker crests. M1 and M2 subequal in size. On upper molars mesoloph short or absent, metaloph and entoloph complete, anterior arm of hypocone extends to the tooth center. On M1 anterior arm of protocone joins with para-

cone, forming protoloph I; postero-lingual crest of paracone tending to meet posterior arm of protocone, forming protoloph II. On M2 and M3 metaloph meeting anterior arm of hypocone. On lower molars ectolophid present, mesolophid short or absent. On m1 and m2 metalophid II and hypolophid complete. On m1 trigonid short and narrow, anteroconid very small. On m2 anteroconid near midline. On m3 metalophid II weak and hypolophid usually absent.

Discussion *Allosminthus* was established by Wang (1985). Later, based on the specimens from Shanxi and Henan, China, Tong (1997) erected a new genus *Banyuesminthus*, including two new species: *B. diconjugatus* and *B. uniconjugatus*. Tong did not compare his new genus with *Allosminthus*. A closer comparison of the above two genera, especially the two type species (*A. ernos* and *B. diconjugatus*), indicates that the two genera are very similar to each other. The differences between them are: in *A. ernos* paracone having a shorter postero-lingual crest and a metaloph meeting anterior arm of hypocone on some M1, and a metalophid I meeting anterior arm of the protoconid on some m2. In fact, these differences represent individual variation of *A. ernos* itself. More interesting is that the short postero-lingual crest of paracone is one of the characteristic features of Tong's *B. uniconjugatus*. Obviously the differences between *Allosminthus ernos* and *Banyuesminthus diconjugatus* represent mostly interspecies differences rather than those between genera. It seems that *Banyuesminthus* is a junior synonym of *Allosminthus*.

Allosminthus cf. *A. diconjugatus* (Tong, 1997)

(Fig. 1; Table 1)

Specimens 3 M1 (IVPP V 14990.1-3), 1 M3 (V 14990.4), 3 m1 (V 14990.5-7) and 4 m2 (V 14990.8-11).

Description and comparison The molars from Erenhot are similar to those of *A. diconjugatus* in basic features and their sizes are within the range of variation of the latter form (Table 1). However, these molars differ from those of *A. diconjugatus* in having sharper main cusps and slimmer transverse lophs, and having a complete metalophid I on m2. These features are slightly more advanced than those of *A. diconjugatus*.

The M3 of *A. diconjugatus* has not been reported. There is a M3 (V 14990.4) from Erenhot. It is similar to that of *A. uniconjugatus* in occlusal features but has more developed lophs. It probably belongs to *A.* cf. *A. diconjugatus*.

Allosminthus majusculus Wang, 1985

(Fig. 2; Table 1)

Specimens A left m1 (IVPP V 14991.1), a right m1 (V 14991.2) and a right m2 (V 14991.3).

Description and comparison The m2 is identical with that of *A. majusculus* in the basic features and size. The two m1's are also similar to that of *Allosminthus* in such occlusal features as: the short and narrow trigonid, the highly reduced anteroconid, complete metalophid II and ectolophid, short mesolophid and the hypolophid joining with hypoconid. In these features they are closer to the m2 of *A. majusculus*. Their sizes are also comparable. The three molars are thus referred to *A. majusculus*.

Allosminthus ernos Wang, 1985

(Fig. 3; Table 1)

There is only one left m2. It is brachydont, with obtuse main cusps and low lophs. The metalophid I and II are complete. The ectolophid is straight and complete. The hypolophid meets the anterior arm of the hypoconid. All the features are identical with those of *A. ernos*. Its

size is also within the range of variation of *A. ernos*.

Aplodontidae Brandt, 1855
***Prosciurus* Matthew, 1903**
***Prosciurus pristinus* sp. nov.**
(Fig. 4)

Holotype A left p4 (V 13575.1).

Specimens A left P4 (IVPP V 13575.2).

Diagnosis A primitive mid-sized *Prosciurus*. Parastyle weak, metaconule single on P4. Mesostylid, mesoconid and ectomesolophid absent, weak hypolophid connecting posterolophid on p4.

Etymology Pristinus, Latin, early, primitive.

Description and comparison Both P4 and p4 are brachydont. P4 is molariformed, with a distinct parastyle. The paracone and metacone are triangularly pyramid in form. The protoloph and metaloph join with the posterior side of protoconule and the anterior side of metaconule respectively. The protoloph is complete. The metaloph does not reach to protocone. The mesostyle and conules are distinct and a single metaconule is well developed. The small facet on the anterior surface of P4 indicates that a small P3 is present in this form. The trigonid of p4 is higher and narrower than the talonid. The metalophid II is complete, but no metalophid I is present. The entoconid is separated from the posterolophid. The hypolophid joins with the hypoconulid. All the above features are those of *Prosciurus*. However, the weak parastyle on P4, the weak hypolophid and the lack of mesostylid, mesoconid and ectomesolophid on p4 show clearly that these two teeth differ from those of the known species of *Prosciurus*. The above features are all primitive in *Prosciurus*. The Erenhot specimens may represent a primitive species of *Prosciurus*, here named as *P. pristinus*.

Prosciurus is known from Late Eocene through Early Oligocene in North America, but only in Early Oligocene in Asia. *P. pristinus* is more primitive than all known species, including the Late Eocene *P. saskatchewensis*. The age of the occurrence of *P. pristinus* is here determined as Late Eocene. Thus, *Prosciurus* appeared in Late Eocene in Asia, as in North America.

Sciuridae Fischer de Waldheim, 1917
Marmotini Pocock, 1923
Marmotini gen. et sp. indet.
(Fig. 5)

There is only a left M1/2 (IVPP V 15003). It is subquadrate in occlusal outline. The crown is unilaterally hypsodont. The long protocone almost occupies the whole lingual side of the M1/2. No hypocone is seen. Among the four transverse lophs the anteroloph, protoloph and posteroloph are complete, but the metaloph does not meet the protocone. These features are similar to those of the Sciurinae, especially to *Spermophilus* of the Marmotini.

The Marmotini are known to range from Early Oligocene through Recent in Europe, from Late Oligocene through Recent in North America and from Early Miocene thought Recent in Asia. If the above identification is acceptable, it would mean that the Marmotini appeared in Asia much earlier than thought before. V 15003 seems represent the earliest marmotini in the world.

2 Geological age of the Houldjin Formation

The rodents described here included five species of three genera: *Allosminthus* cf. *A. diconjugatus*, *A. majusculus*, *A. ernos*, *Prosciurus pristinus* and Marmotini gen. et sp. indet. *Allosminthus majusculus* and *A. ernos* have been known only from Late Eocene (Caijiachong For-

mation). *A. diconjugatus* is so far known from latest Middle Eocene through Late Eocene. Since it is slightly more advanced than *A. diconjugatus*, *A.* cf. *A. diconjugatus* is probably from Late Eocene, as well. *Prosciurus pristinus* is probably from Late Eocene, too. Taken as a whole, the age of the Houldjin Formation is to be assigned to Late Eocene as suggested before (Wang, 1997, 2001, 2007a, b; Qiu and Wang, 2007).

References

Black C C, 1963. A review of the North American Tertiary Sciuridae. Bull Mus Comp Zool, **130**(3): 113–248

Korth W W, 1989. Aplodontid rodents (Mammalia) from the Oligocene (Orellan and Whitneyan) Brule Formation, Nebraska. J Vert Paleont, **9**(4): 400–414

Matthew W D, Granger W, 1923. Nine new rodents from the Oligocene Mongolia. Am Mus Novit, (102): 1–10

McKenna M C, Bell S K, 1997. Classification of Mammals above the Species Level. New York: Columbia University Press. 1–631

Qiu Z X (邱占祥), Wang B Y (王伴月), 2007. The Chinese paraceratheres. Palaeont Sin (中国古生物志), N S, (29): 1–405 (in Chinese with English summary)

Russell L S, 1972. Tertiary mammals of Saskatchewan. Part II: The Oligocene fauna, non-ungulate orders. R Ontario Mus, Life Sci Contrib, **84**: 1–63

Tong Y S (童永生), 1997. Middle Eocene small mammals from Liguanqiao Basin of Henan Province and Yuanqu Basin of Shanxi Province, Central China. Palaeont Sin (中国古生物志), N S, (26): 1–256 (in Chinese with English summary)

Wang B Y, 1985. Zapodidae (Rodentia, Mammalia) from the Lower Oligocene of Qujing, Yunnan, China. Mainzer geowiss Mitt, **14**: 345–367

Wang B Y (王伴月), 1987. Discovery of Aplodontidae (Rodentia, Mammalia) from Middle Oligocene of Nei Mongol, China. Vert PalAsiat (古脊椎动物学报), **25**(1): 32–45 (in Chinese with English summary)

Wang B Y (王伴月), 1997. Problems and recent advances in division of the continental Oligocene. J Stratigr (地层学杂志), **21**(2): 81–90 (in Chinese with English abstract)

Wang B Y (王伴月), 2001. Eocene Ctenodactyloids (Rodentia, Mammalia) from Nei Mongol, China. Vert PalAsiat (古脊椎动物学报), **39**(2): 98–114 (in Chinese with English summary)

Wang B Y (王伴月), 2007a. Late Eocene lagomorphs from Nei Mongol, China. Vert PalAsiat (古脊椎动物学报), **45**(1): 43–58 (in Chinese with English summary)

Wang B Y (王伴月), 2007b. Late Eocene cricetids (Rodentia, Mammalia) from Nei Mongol, China. Vert PalAsiat (古脊椎动物学报), **45**(3): 195–212 (in Chinese with English summary)

Wang B Y (王伴月), Dashzeveg D, 2005. New Oligocene sciurids and aplodontids (Rodentia, Mammalia) from Mongolia. Vert PalAsiat (古脊椎动物学报), **43**(2): 85–99

Wood A E, 1937. Rodentia. Part II of "the mammalian fauna of the White River Oligocene" by Scott W B, Jepsen G L et Wood A E. Trans Am Philos Soc, N S, **28**: 155–269

Wood A E, 1980. The Oligocene rodents of North America. Trans Am Philos Soc, **70**(5): 1–68